

FM-200™, THE NEW SOLUTION FOR FIRE PROTECTION

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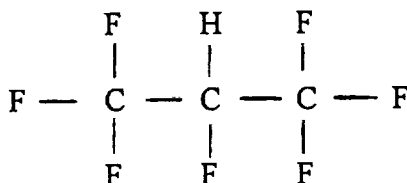
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For more than two decades, halon 1301 has been protecting personnel and valuable aircraft and aerospace equipment from the hazards of fire. Only halon 1301 offered the advantages of being clean, odorless, colorless, electrically non-conductive and safe for occupied areas. However, concerns about the depletion of stratospheric ozone and the resulting Montreal Protocol mandated the production phase-out of halon 1301 on December 31, 1993.

Prior to this phase-out, Great Lakes Chemical Corporation, the world's leading manufacturer of halon, directed substantial research efforts toward the rapid development of a safe, clean, and effective halon replacement. Some of the criteria for the development of a clean agent included:

- that it be an effective fire extinguisher;
- that it be safe for personnel;
- that it be safe for the environment;
- that it be safe for valuable assets;
- that it be cost effective; and,
- that it be able to withstand the rigors of independent approvals.

Much effort was put into this endeavor. As a result of this research, Great Lakes developed FM-200™. Chemically FM-200™ is 1,1,1,2,3,3,3-hepta-fluoropropane. The molecular structure for FM-200™ is as follows:



Studies show that the decomposition of FM-200™ begins with loss of the single hydrogen atom. This provides a point of reaction giving FM-200™ a low atmospheric lifetime of 31 years. FM-200™, unlike its predecessor halon 1301 contains no bromine and has a zero ODP.

The physical properties of FM-200™ compared to halon 1301 are:

	FM-200™	Halon 1301
Chemical Formula	CF ₃ -CHF-CF	CF ₃ Br
Molecular Weight	170.03	148.91
Boiling Point °F	2.55	-71.95
Vapor Pressure @ 70°F	58.8 psia	214 psia

FM-200™ is an effective fire extinguisher and is U.L. listed at a concentration of 5.8% v/v for Class A fires. For Class B fires, 5.5 to 6.7% v/v of FM-200™ will extinguish fires from unleaded gasoline, aviation gasoline, number 2 diesel, n-heptane and hydraulic fluid. FM-200™ is also effective against Class C hazards and is approved for this use by U.L. and FM (Factory Mutual Research Corporation).

As a fire suppression agent, FM-200™ is more of a physical-acting agent compared to halon, which is primarily a chemical-acting agent. FM-200™ physically removes heat from the flame front. This lowers the flame temperature and reduces the combustion reaction rate to the point where the combustion reaction can no longer sustain itself. Furthermore, it is likely that extinguishment by FM-200™ also involves a chemical mechanism. Trace amounts of Fluorine are released from the FM-200™ molecule and reacts with transient combustion species in the chain propagation reactions. This ultimately halts these reactions. Because of this slightly different flame suppression mechanism, the design concentration of FM-200™, accounting for a higher molecular weight, is 1.66 v/v times higher than halon. Extinguishant times are less than 10 seconds or about the same as halon 1301.

In addition to its efficiency as an extinguishant, FM-200™ has been thoroughly tested and is proven safe for occupied enclosures. The acute toxicity of FM-200™ is above 800,000 ppm. At 80% concentration (800,000 ppm) in 20% oxygen, all the animals survived exposure. The cardiac sensitivity of FM-200™ was tested. Based on the results of these tests, the U.S. EPA SNAP assigned a NOAEL of 9% v/v and a LOAEL of greater than 10.5%. Other agencies interpret the cardiac sensitivity differently. Australia allows 14% v/v as a safe level for occupied exposure providing egress takes place within 30 seconds of discharge. In contrast, the NOAEL for halon 1301 was 7% and the LOAEL was 10%. In other toxicity tests, FM-200™ demonstrated the following:

- negative results in a 14-day screening in male and female rats at 10% active;
- negative in central nervous system suppression;
- negative in developmental and reproductive toxicity;

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- negative in developmental and reproductive toxicity;

- non-mutagenic in all genotoxicity tests;
- negative as a respiratory sensitizer;
- not metabolized or retained by living systems;
- exhaled unchanged by living organisms.

FM-200™ is safe for valuable assets. FM-200™ is a highly purified reagent-grade gaseous chemical that leaves no residue. FM-200™ is non-conducting and non-corrosive; furthermore, it has a higher dielectric constant than halon 1301.

FM-200™ is safe for the environment because FM-200™ is not an emissive agent. In contrast, a fire is a very polluting event that emits copious amounts of gases, many of which are toxic and greenhouse gases. In addition, the remnants of fires leave significant residue for clean up. Furthermore, the repair or rebuilding process from fires also contributes considerably to global warming or climate change. The advantage of FM-200™ is that it quickly extinguishes a fire, which greatly reduces the emissions of toxic gases. FM-200™ also reduces collateral damage as an HFC. FM-200™ has a zero ozone depletion potential and a low atmospheric lifetime of 31 years according to the U.S. EPA SNAP document. The GWP over a 500-year integrated time horizon is 600.

FM-200™ has withstood the rigors of independent approvals. The U.S. EPA's SNAP program accepts FM-200™ as the most effective HFC replacement for halon 1301. Underwriters' Laboratories (U.L.) and Factory Mutual (FM) recognize equipment approvals and component listings. In addition to the above approvals, FM-200™ is included in the NFPA 2001 standard as a halon 1301 replacement. Furthermore, FM-200™ is approved by the Loss Prevention Council in the U.K. (LPC), NICNAS in Australia, the Japanese Fire Defense Agency, the Hong Kong Fire Authority, the U.S. Coast Guard, the U.S. F.A.A., and the International Maritime Organization in addition to several others.

Thank you for the opportunity to tell you about FM-200™, the most widely accepted halon replacement on the market.

CORROSION PROTECTION REPLACEMENTS